Mott Corporation

Sintered Metal HEPA Filter

Technology Need:

Conventional disposable glass-fiber high-efficiency particulate air (HEPA) filters are used throughout the Department of Energy (DOE) complex in various systems. For instance, high level waste (HLW) tanks which are located outdoors are equipped with a ventilation system to maintain the tank contents at negative pressure (-1.0" water column), which prevents the release of radioactive material to the environment. These systems are equipped with conventional disposable glass-fiber HEPA filter cartridges. HEPA filters are critical elements for the prevention of the release of material to the atmosphere and thereby serve to protect workers, the public, and the environment.

However, these filters require routine removal, replacement, and disposal. This process is not only expensive, but also subjects personnel to radiation exposure and adds to an ever growing waste disposal problem. Conventional HEPA filters also create safety concerns in the areas of filter media strength, water damage, and operation in environments with elevated temperatures. There is a need for high quality, durable, moisture tolerant HEPA filters which can be regenerated or cleaned in situ as an alternative to conventional disposable HEPA filters.

Technology Description:

Alternatives to glass fiber filter media hold great promise for use in HEPA filters. The Mott Corporation is developing a sintered metal HEPA filter to replace the conventional glass filters. These filters have the potential for a long life and can be regenerated in situ. In addition to eliminating the costs associated with conventional filter replacement and disposal, the strong filter media will reduce the potential for a catastrophic HEPA filter failure due to high moisture content or fire.

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For cleaning, one or more spray nozzles contact the media the full length of the cylinder. Reverse flow of clean air during the cleaning will assist in dirt and sludge removal by creating a turbulence at the surface and flow out of the pore structure. This air flow will not change the pressure of the tank relative to the atmosphere. Scale-up is simply the multiplication of one element, each element operates independently of the others.

Benefits:

- Filters can be regenerated without being removed from the ventilation system
- Eliminates personnel radiation exposure associated with removal of plugged filters
- Eliminates high costs of filter replacement & disposal
- Discharges from the system are compatible with the HLW tank contents (e.g., no organics or chlorides), therefore preventing generation of a waste stream that would require separate treatment

▸Filter systems are moisture tolerant both to minimize the possibility of soluble cesium releases and to meet the other performance requirements

▸Sintered metal filters are stronger structurally, thus reducing the potential of a filter failure due to media breakthrough, moisture, or fire in the process ventilation system

▸In situ regenerative system may also be suitable to recover nuclear materials, such as Plutonium collected on HEPA filters from glove box ventilation systems

Status and Accomplishments:

Mott developed several prototype, regenerable, HEPA filter elements for performance testing at the Savannah River Technology Center (SRTC) in the HEPA Filter Test Assembly (HFTA). The filters were tested to determine the feasibility of regenerating or washing them in situ with a liquid after becoming plugged with simulated HLW sludge, simulated HLW salt, and atmospheric dust. They were tested in a hostile environment, where they would plug rapidly, in order to maximize the number of filter cleaning cycles that would occur in a specified period of time.

The Mott filters passed the standard in-place Di-Octylphthalate (DOP) leak test of HEPA filters with an efficiency of 99.97% removal of 0.3 micron particles or better at the start, middle, and end of the test campaign. The Mott filter was found to be insensitive to high humidity or moisture conditions. The filters were easily cleaned in situ and recovered to approximately the original differential pressure and airflow, even after numerous plugging and cleaning cycles. Test data indicates promising results and shows that the sintered metal filter is suitable as an in situ cleanable HEPA filter for ventilation systems.

Mott fabricated full-scale prototype filters for testing. Five full-scale prototype filters underwent DOP testing by Air Techniques, Incorporated (ATI) at the Oak Ridge National Laboratory (ORNL). Three of the five Mott full-scale filters tested passed the Di-Octylphthalate (DOP) retention test with a greater than 99.97% efficiency. The two elements that failed at ATI were returned to Mott for examination. It was confirmed that the failure was due to the epoxy seal cracking, not the quality of the porous media.

HLW personnel provided operational performance requirements to allow detailed design of regenerative HEPA filter systems for cold and hot demonstration and deployment at SRS. Prior to proceeding with detailed design, NETL determined that lack of near-term commitment for demonstration and deployment would jeopardize future success. Therefore, this project is currently undergoing closeout.

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Online Resources:

Office of Science and Technology, Technology Management System (TMS), Tech ID # 2405
http://ost.em.doe.gov/tms

The National Energy Technology Laboratory Internet address is http://www.netl.doe.gov

For additional information, please visit the Mott Corporation website at http://www.mottcorp.com/